

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

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MULTIMEDIA UNIVERSITY

SUPPLEMENTARY EXAMINATION

TRIMESTER 1, 2015/2016

PCM0035 – GENERAL CHEMISTRY
(All sections / Groups)

17 NOV 2015
9.00 AM – 11.00 AM
(2 HOURS)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 3 pages only excluding the cover page.
 2. Attempt **ALL** questions. Distribution of the marks for each question is given.
 3. Please write all your answers in the answer booklet provided.
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QUESTION 1 [20 MARKS]

- a) Answer the following.
- Draw the Lewis symbols for Mg^{2+} and P^{3-} . [1 mark]
 - Draw the Lewis structures and state the total number of valence electrons for the compounds of dihydrogen dioxide (H_2O_2) and hydroxidoxonitrogen (HNO_2). [4 marks]
- b) Among the exceptions to the octet rule are the odd-electron molecule and the expanded octet. For each exception, provide a specific example of a molecule. Draw the Lewis structure for each specific example and explain why it does not follow the octet rule. [4 marks]
- c) Given that the energy of a photon emitted by a hydrogen atom is $-4.905 \times 10^{-20} \text{ J}$. [$R_H = 2.18 \times 10^{-18} \text{ J}$; $h = 6.63 \times 10^{-34} \text{ J.s}$; $c = 3.00 \times 10^8 \text{ m/s}$]
- Find the wavelength of the photon emitted by the hydrogen atom. [2 marks]
 - Determine the initial state (n_i) of the electron from the hydrogen atom, if it moves to a final state of $n = 4$. [3 marks]
- d) Write the quantum number values of n , l and m_l for $2p$ -orbitals. [1 mark]
- e) Which of the following species has the largest size and which has the smallest size. Justify your answer.
Na, Na^+ , Al, Al^{3+} [2 marks]
- f) Write the *electron configurations* for the elements given below and determine the group in the periodic table that each element belongs to.
- Element with atomic number = 14 [1 mark]
 - Element with atomic number = 6 [1 mark]
 - Element with atomic number = 20 [1 mark]

QUESTION 2 [20 MARKS]

- a) The following molecules have different boiling points and viscosity. Predict which one has higher boiling point and larger viscosity. Explain your answer.

(i)	1-propanol	$\text{H}_3\text{C}-\text{O}-\text{CH}_2\text{CH}_3$ Methoxyethane
(ii)	HCl	HF

[4 marks]

- b) **Figure 1** shows a phase diagram of carbon dioxide.
- Name point E. [1 mark]
 - Predict the most stable physical state at point D. [0.5 mark]
 - What happens if temperature is decreased from point z to point y. [0.5 mark]
 - How does this diagram differ from phase diagram of water? [1 mark]

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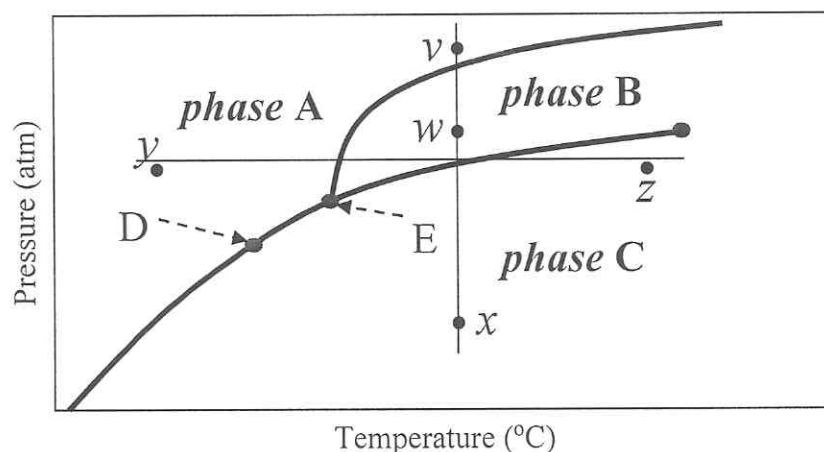


Figure 1

- c) For the reaction: $C + D \rightarrow E$, the rate equation is given by: $\text{Rate} = k [C]^2 [D]$. Answer the questions below:
- What is the overall order of reaction. [1 mark]
 - Find the unit for the rate constant, k . [2 marks]
 - What will happen to the rate if the concentration of A is doubled. [1 mark]
 - What will happen to the rate if the concentration of B is halved. [1 mark]
 - What will happen to the rate if the concentration of A is doubled and the concentration of B is halved, assuming all changes take place at constant temperature? [1 mark]
- d) Consider the following reaction at a particular temperature:



Given that the equilibrium concentrations are $[\text{NO}_2] = 2.50 \text{ M}$, $[\text{N}_2\text{O}] = 3.60 \text{ M}$ and $[\text{NO}] = 0.003 \text{ M}$,

- What is the value of the equilibrium constant, K_c ? [2 marks]
 - If $[\text{NO}]$ is removed from the system at equilibrium, which direction will the reaction shift? [1 mark]
- e) The following data were measured for the reaction,



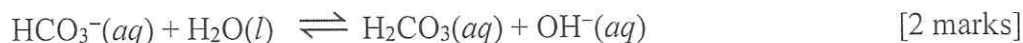
Experiment	$[\text{CH}_4]$	$[\text{O}_2]$	Initial Rate (M/s)
A	0.25	0.24	0.2130
B	0.25	0.12	0.1065
C	0.36	0.10	0.1192
D	0.18	0.10	0.0596

- Find the rate law for the reaction. [3 marks]
- Determine the overall order of the reaction? [1 mark]

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QUESTION 3 [20 MARKS]

- a) For the reaction below, indicate the Brønsted-Lowry acid and conjugate base.



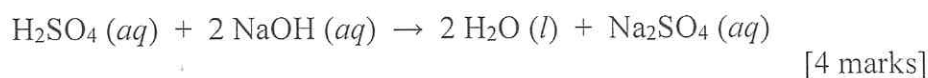
- b) Determine the concentration of OH^- ion at 25 °C for each solution below and determine whether it is acidic, basic or neutral.

i) $[\text{H}^+] = 7.5 \times 10^{-5} \text{ M}$ [2 marks]

ii) $[\text{H}^+] = 1.0 \times 10^{-7} \text{ M}$ [2 marks]

- c) Calculate how many grams of NaOH is needed to prepare a 0.52 L solution with pH 7.5. [Atomic mass: Na = 23; O = 16; H = 1] [3 marks]

- d) Automobile batteries use 3.00 M of H_2SO_4 as an electrolyte. How many liters of 1.20 M of NaOH will be needed to neutralize 2225 mL of automobile battery acid? The balanced chemical equation for the neutralization process is given below:



- e) A metal, X reacts with bromine to form XBr_3 . Continuous electrolysis of XBr_3 by a steady current of 5.62 A for half an hour deposits 3.25 g of the metal, X. Calculate the molar mass of the metal, X. [Faraday constant = 96 500 C/mol e^-] [3 marks]
- f) Based on their electronegativity and/or molecular structure, pick which acid is stronger and give reasons.
- i) HF or HI [2 marks]
- ii) HClO or HClO_3 [2 marks]

End of Paper